HW:

p. 830: 1, 3, 5, 9, 11

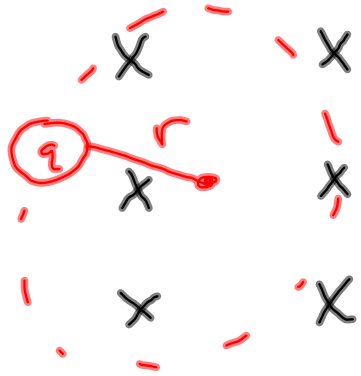
A proton is moving in a circular orbit of radius 14 cm in a uniform 0.35 T magnetic field perpendicular to the velocity of the proton. Find the speed of the proton.

What would happen to the radius of orbit if an electron were moving at the same speed as the proton?

$r = .14\ m$

$B = .35\ T$

$q = 1.6E\text{-}19\ C$



$m_p = 1.67E\text{-}27\ kg$

$$r = \frac{mv}{qB}$$

$$v = \frac{qB}{rm}$$

$$= 4.7E6\ m/s$$

In an experiment designed to measure the magnitude of a uniform magnetic field, electrons are accelerated from rest through a potential difference of 350 V and then enter a uniform magnetic field that is perpendicular to the velocity vector of the electrons. The electrons travel along a curved path because of the magnetic force exerted on them and the radius of the path is measured to be 7.5 cm. What is the magnitude of the magnetic field?

$$\Delta K + \Delta U = 0$$

$$\frac{1}{2} m_e v^2 + q\Delta V = 0$$

$$v = \sqrt{\frac{-2q\Delta V}{m_e}}$$

$$= 1.1E7 \text{ m/s}$$

$$r = \frac{mv}{qB}$$

$$B = \frac{m_e v}{q_e r}$$

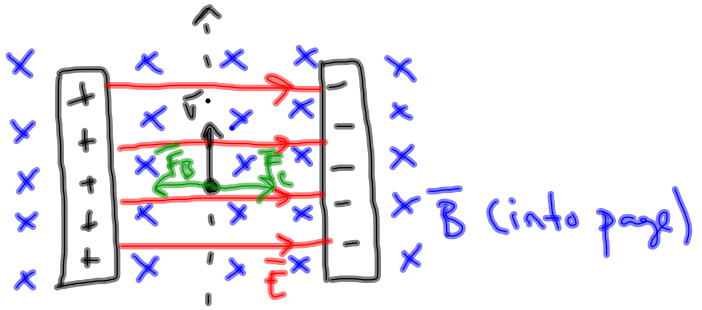
$$= 8.4E-4 \text{ T}$$

Applications of Moving charged Particles:

Lorentz force:

$$\bar{F} = q\bar{E} + q(\bar{v} \times \bar{B})$$

1) Velocity Selector



$qE = qvB$ — slit

source of ions/charged particles

$$v = \frac{E}{B}$$

2) Mass Spectrometer

$$r = \frac{mv}{qB}$$

3) Cyclotron